An Integrated Evaluation of Nonspeech Oral Motor Treatments

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Nonspeech oral motor treatments (NSOMTs)—in one form or another—have been used by speech-language pathologists (SLPs) for many years (Ruscello, 2008). Research suggests that the use of NSOMTs is widespread; in fact, 85% of responding SLPs reported using NSOMTs to treat speech sound production disorders in children (Lof & Watson, 2008). Given that NSOMTs have been used by practitioners over many years, one might expect to find a strong research foundation in the professional literature; however, the evidence supporting such treatments consists primarily of uncontrolled anecdotal reports (Lass & Pannbacker, 2008). The articles that make up this clinical forum converge on a single conclusion: Currently, there is insufficient evidence to support the routine clinical application of NSOMTs to remediate developmental speech sound disorders (Lass & Pannbacker, 2008; Lof & Watson, 2008; Ruscello, 2008).

CLINICAL QUESTIONS; TENTATIVE CONCLUSIONS

Previously, eight questions were posed regarding the evaluation of potential treatment methods (Powell, 2008). In this epilogue, evidence is discussed to formulate tentative conclusions regarding the use of NSOMTs in the treatment of developmental speech sound disorders. Theoretical and clinical challenges for NSOMTs are then summarized and discussed.

Are NSOMTs Consistent With Accepted Theories of Communication and Learning?

According to modern theories, speech production entails some degree of integration of the cognitive–linguistic and motor systems (Kent, Adams, & Turner, 1996). NSOMTs, in contrast, focus almost exclusively on motor control, and the cognitive–linguistic aspects of speech production are rarely acknowledged or considered in any depth. Bahr (2001), for example, identified speech appraisal as “an extremely important part of the oral motor evaluation” (p. 151). Nevertheless, her approach was limited to subjective assessments of jaw, lip, and tongue movements, intelligibility, and sound sequencing; analyses of the phonetic and phonological aspects of speech production were neither described nor discussed. Similarly, Rosenfeld-Johnson (2001) described subjective procedures for assessing muscular function during
respiration, phonation, resonation, and articulation; however, discussion of the linguistic aspects of speech production was limited to a single sentence (i.e., “Any basic articulation test can be used to describe a clients [sic] oral phoneme-error pattern,” p. 11). Because NSOMTs effectively dissociate oromotor and linguistic aspects of speech production, they are largely inconsistent with current theories of speech production (Kent et al., 1996). NSOMT approaches are motivated by an assumption that improved oral function, established during nonspeech tasks, will have a direct and facilitative impact on articulation (e.g., Marshalla, 2004; Rosenfeld-Johnson, 2001; Strode & Chamberlain, 1997). Studies of developmental speech physiology, however, have challenged the assumption that speech development evolves from nonspeech motor control (Moore & Ruark, 1996; Ruark & Moore, 1997; discussions can be found in Forrest, 2002; Lof, 2003). Data suggest independence of motor control for speech and nonspeech actions (e.g., Ziegler, 2006); thus, the underlying assumptions of NSOMTs are largely incongruent with both theory and data (Ruscello, 2008).

The underlying tenets of NSOMTs are inconsistent with theories of speech sound acquisition and generalization as well. Nonspeech oral motor exercises (NSOMEs) are motivated by static articulatory postures for isolated target sounds, with little consideration of the dynamic factors (e.g., coarticulation) that impact the production of syllables.1 For example, Rosenfeld-Johnson (2001) suggested the use of exercises such as bubble blowing, kissing, and humming to improve bilabial motor control. As Tyler (2005b) observed, the movements elicited by such exercises may have little resemblance to speech sounds. Although bubble blowing, kissing, and humming involve the lips, there are important differences between these actions and the production of bilabial speech sounds. They differ, for example, in airflow, placement, manner, and transition characteristics.

In terms of learning theory, NSOMTs are motivated by an expectation that part-to-whole training on nonspeech oromotor movements is both requisite and facilitative for speech production (Ruscello, 2008). This position is inconsistent with the documented effectiveness of speech-based treatments (Gierut, 1998). Although there is considerable variability among children, generalization of correct sound production is typically enhanced when treatment conditions emphasize the communicative impact of speech sound distinctions (e.g., Kamhi, 2000). If articulator movements are highly decontextualized from speech—as is the case with NSOMTs—then generalization to speech is likely to be limited (McReynolds, 1989). Indeed, a primary strategy for increasing generalization is to reduce differences between the treatment and the natural environment (McReynolds, 1989).

**Conclusion.** The assumptions that underlie NSOMTs differ markedly from commonly accepted theories of speech production, oral motor function, and phonological learning.

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1Marshalla (2004) wrote, “Traditional articulation therapy always has supported the concept of teaching production of discrete phonemes prior to working on syllables, words, phrases and sentences” (p. 31). Historically, however, the primacy of the syllable has been championed by many (e.g. McDonald, 1964; Stetson, 1928/1988; Winitz, 1975). The importance of the syllable has been reaffirmed by more recent phonological theories, as well as clinical assessment procedures (e.g., Bernhardt & Stemberger, 2000; Schwartz, 1992).

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**Do NSOMTs “Work”?**

To evaluate the effectiveness of any treatment, one must control extraneous variables (e.g., history, maturation, differential assignment to conditions) that might jeopardize the internal validity of the study. Without such experimental controls, it is impossible to discern whether observed changes were attributable to the treatment itself, whether the child “outgrew” the problem (i.e., self-corrected), or whether another factor (or a combination of factors) contributed to the outcome (Schiaivetti & Metz, 2005). Some advocates of NSOMTs emphasize the inclusion of NSOMEs as an adjunct to more established treatments (e.g., Marshalla, 2004). Lof and Watson (2008) reported that many SLPs employ a mix of NSOMEs and more traditional speech-based treatments. In such cases, it is imperative to control for multiple-treatment interference (Richards, Taylor, Ramasamy, & Richards, 1999); otherwise, it is impossible to identify which aspect or combination of treatments caused the change.

Evidence-based practice differentiates among hierarchically arranged levels of evidence. Lass and Pannbacker (2008) noted that most controlled experimental studies (Levels I and II) have found NSOMTs to be ineffective for the treatment of developmental speech sound disorders. Descriptive anecdotal reports have been offered in support of NSOMTs; however, these have typically been in the form of testimonials without experimental design or control (evidence levels III and IV; see Lass & Pannbacker, 2008). Although anecdotal reports of success should not be ignored, neither should they be accepted as sufficient for determining the effectiveness of the treatment approach.

**Conclusion.** The efficacy of NSOMTs for the treatment of developmental speech sound disorders has not been established.

**Do NSOMTs Work Better Than More Established Options?**

This clinical question is related to the efficiency of treatment options. A treatment is efficient if it causes a comparable amount of change more quickly than another treatment or if it causes a greater amount of change in a comparable time period (see Gierut, 2001). To date, few scientific studies have compared the speech outcomes of individuals receiving NSOMTs relative to other treatments; consequently, there is inadequate evidence of efficiency (Lass & Pannbacker, 2008).

**Conclusion.** NSOMTs have not been shown to be more efficient than speech production-based treatments.

**For Whom Do NSOMTs Work?**

As noted previously, subgroups of children with speech sound production disorders have been identified (Shriberg et al., 2005). Moreover, deficits of oromotor functioning are common to some subgroups, but not to all children with speech sound disorders (Bradford & Dodd, 1996). Given the diversity that characterizes children with speech disorders, one might hypothesize that NSOMTs would be most beneficial to children whose speech disorder is clearly related to oromotor deficits (i.e., dysarthria), and of questionable benefit to children whose oromotor control is intact. Unfortunately, experimentally controlled data are not available to test this hypothesis (Lass & Pannbacker, 2008).
Proponents of NSOMTs have advocated the use of NSOMEs even when clients have no discernable problems with oromotor control, including children with phonological disorders (e.g., Marshalla, 2004, p. 109; Rosenfeld-Johnson, 2001, p. 3), as well as those with hearing impairments (e.g., Loncar-Belding, 1998, p. 5; Orr, 1998, p. 1). NSOMEs have even been incorporated into multicultural–multilingual language groups targeting functional communication (Larroudé, 2004). Although NSOMTs have been used with various subgroups of children with speech sound disorders, the relative effectiveness of NSOMT approaches has not been systematically explored across or within subgroups.  

**Conclusion.** NSOMTs have not been shown to be effective with various subgroups of children with speech disorders.

### How Much NSOMT Is Optimal?

When a treatment is initiated, the professional should have a clear concept of treatment success and the associated criteria for discharge (Eger, 1997). In medicine, for example, a course of treatment is prescribed for a period of time, and the outcome of that intervention will dictate the need for additional (and perhaps more aggressive) treatments. Unfortunately, few data exist regarding the optimal course of speech sound treatments; therefore, it is especially important for SLPS to develop a framework for monitoring change as a function of intervention (Campbell & Bain, 1991; Olswang & Bain, 1985).

NSOMTs are frequently incorporated into treatment plans for children with severe speech sound disorders (LoF & Watson, 2008), and the duration of treatment may be quite long. Because little is known about the optimal course of treatment, it is possible that an SLP may continue to provide a treatment beyond what is optimal in hopes that it will benefit the client eventually. Patience, in such cases, is not a virtue.

**Conclusion.** At present, there exists no evidence that NSOMTs are necessary; thus, there is no evidence of an optimal course of treatment.

### Are There Contraindications to the Implementation of NSOMTs?

There are few data from which one may draw inferences regarding contraindications. It has been suggested that NSOMTs are innocuous; however, Hayes (2005) reported that response generalization for two participants actually decreased when NSOMT activities were paired with traditional articulation treatment procedures as part of a single-subject interaction design (McReynolds & Kearns, 1982). This apparent interference effect suggests that the use of certain NSOMTs may be counterproductive with some children.

NSOMEs often involve the use of straws, horns, and other objects that involve mouth contact. Accordingly, such equipment should be used only if appropriate infection control procedures are followed (Grube & Nunley, 1995). Ideally, each child would use a separate set of equipment, which would be carefully disinfected and stored when not in use. Safety issues also impact the use of certain NSOMT procedures with children who have significant limitations impacting the sensory motor, swallowing, cognitive, and/or behavioral domains. Criteria for safe use of NSOMT procedures need to be developed and tested.

**Conclusion.** Contraindications to the use of NSOMTs have not been systematically identified or assessed.

### What Is the Ratio of Benefit to Cost?

Several factors need to be considered relative to the ratio of NSOMT benefits and costs. First, direct costs associated with NSOMT equipment and infection control procedures must be considered. In the absence of efficiency data, it is not currently possible for one to ascertain whether the direct costs associated with NSOMTs will be offset by accelerated progress. Second, indirect costs should be considered. Because NSOMTs may occupy approximately 50% of the allotted time for each treatment session (Bahr, 2001), their use could actually increase the number of treatment sessions necessary to attain treatment goals (i.e., time spent on unsubstantiated NSOMEs may reduce access to effective speech-based treatments; Forrest, 2002).

**Conclusion.** Any statement regarding the ratio of benefits to costs must be considered speculative due to insufficiency of data to evaluate the use of NSOMTs to treat developmental speech sound disorders.

### At What Point Is it Ethical To Consider NSOMTs Appropriate for Clinical Use?

Principles and rules of the American Speech-Language-Hearing Association (ASHA, 2003) Code of Ethics should be considered carefully before one incorporates any treatment into clinical practice. Professionals must uphold the welfare of their clients, provide services competently, and uphold their responsibilities to the public and the profession (Irwin, Pannbacker, Powell, & Vekovius, 2007). The efficacy of NSOMTs has not been clearly established; therefore, the procedures are best viewed as experimental in nature. In other words, such approaches must be examined under controlled conditions with the appropriate protections in place (including procurement of informed consent and ethics board approval). There are legal and ethical ramifications associated with the use of unsubstantiated treatments, especially when data exist in support of more established treatments (Forrest, 2002; Gierut, 1998).

**Conclusion.** NSOMTs have not been validated for the treatment of developmental speech sound disorders; therefore, scientific and ethical safeguards (e.g., informed consent) should be observed to ensure client welfare and safety.

### DISCUSSION

ASHA emphasizes the role of scientific and clinical evidence as a guiding principle of service (ASHA, 2004). Although NSOMTs are widely used, few controlled studies have evaluated their efficacy for treating developmental speech sound disorders. This lack
of evidence raises important questions about the routine use of NSOMTs with this population. In fact, concerns about such methods have been voiced by many prominent clinicians and researchers (e.g., Baker & Bernhardt, 2004; Bankson & Bernthal, 2004; Bowen, 2005; Clark, 2003; Davis & Velleman, 2000; Forrest, 2002; Hodge, 2002; Kamhi, 2006; Lof, 2002, 2003; Lof & Watson, 2008; Pannbacker, 2004; Ruscello, 2008; Rvachew, 2005; Shelton, 2005; Shriberg, 2003; Tyler, 2005b; Weismer, 1996; Williams, 2003). It is an ethical and professional responsibility of those who advocate NSOMTs—as well as those who wish to use them—to gather data to assess and document treatment effectiveness. As Shelton (2005) noted, the process of investigating treatments requires approval by the appropriate review board(s), a method for documenting informed consent, and expertise in research design and data analysis. In light of the controversial and unproven status of NSOMTs in the management of developmental speech sound production disorders, there exist clear theoretical and applied challenges that must be addressed.

**Theoretical Challenges**

Johnston (1983) argued that “theories are not mere amusement for scholars, nor the unfortunate burden of reason; they are powerfully practical tools that serve our clinical endeavors”. A sound theory helps one to design and define assessment and treatment procedures, to predict and evaluate the impact of intervention, and to hypothesize as to why the treatment is successful. As noted previously, NSOMTs are largely inconsistent with current theories of speech production and learning. Specifically, it is important to develop a theory of NSOMTs that addresses the role of cognitive—linguistic factors in speech production, the independence of speech and nonspeech motor control, and the roles of context and function in sound learning. In addition, the motivation for NSOMTs suggests that their potential for benefit is largely restricted to those individuals who have an underlying deficiency of oromotor functioning. It is important for the underlying theory to provide a clear rationale for use of the treatment with a well-defined population. Once the theory is defined, it must be tested systematically and revised to account for new findings.

**Clinical Challenges**

**Assessment.** The importance of assessing both phonetic and phonemic aspects of speech has been emphasized (Bleile, 2002; Davis, 2005; Gibbon, 1999; Gierut, 2001; Goldstein & Iglesias, 2001; Howard, 2004; Ingram & Ingram, 2001; Miccio, 2002; Tyler, 2005a; Williams, 2005; and many others). A comprehensive assessment informs differential diagnosis and drives treatment decisions (Davis, 2005; Goffman, 2005; Velleman, 2005). Despite the generally acknowledged importance of analyzing both phonetic and phonemic aspects of speech, the assessment methods recommended by most NSOMT advocates are quite limited in scope. As Marshalla (2004) noted, “assessment of oral-motor abilities is almost exclusively visual” (p. 15). Bahr (2001) also recommended the use of direct visual observation, as well as a case history form and checklists. Unfortunately, the recommended procedures have not been shown to meet generally accepted standards of reliability or validity (such as those described by Salvia & Ysseldyke, 2004). It is essential for the reliability of judgment to be demonstrated, both within and across observers. In addition, subjective observational data must be validated against more objective measures. Given the emphasis that NSOMTs place on the assessment of oral—facial anatomy and function, it would be especially appropriate to validate subjective observational assessment of articulator movement and strength against more objective instrumental techniques (e.g., Baken & Orlikoff, 1999; Ball & Code, 1997; Fletcher, 1992; Ladefoged, 2003).

**Treatment.** To date, NSOMTs have been shown to be effective neither as freestanding treatments nor as adjuncts to more accepted modes of treatment (Lass & Pannbacker, 2008). In contrast, there exist considerable data to support speech-based treatments that emphasize sensory motor, cognitive—linguistic, and/or functional aspects of speech (Gierut, 1998). These treatments usually provide some degree of motor practice, but they differ markedly from NSOMTs in that they elicit and stabilize sound production in the context of speech.

Some treatment approaches are designed to address both sensory motor and cognitive—linguistic aspects of speech production. For example, the use of contrastive minimal pairs not only emphasizes meaningful phonological contrasts, but also provides motor practice as the speaker must alternate between contrastive articulatory gestures. Technology, too, is proving to be a valuable adjunct to more traditional treatments. Electropalatography, for example, has been shown to be effective in remediating certain speech disorders (e.g., Dagenais, Critz-Crosby, & Adams, 1994; see Hardcastle & Gibbon, 1997, for an overview). In comparison to more established speech remediation approaches, the evidence base for NSOMTs is extremely limited. Those who advocate NSOMTs must accrue a similarly persuasive research base to support the efficacy of the treatments. Data are needed to evaluate the effectiveness of treatment with different diagnostic subgroups, as well as to evaluate the efficiency of treatment vis-à-vis competing approaches. Given the inadequacies of NSOMTs for children with speech sound disorders, there is a great need for an improved theoretical basis; reliable and valid assessment; and systematic, unbiased, and controlled studies of treatment effectiveness and efficiency.

**CONCLUSION**

The articles in this clinical forum raise serious concerns about the widespread clinical application of NSOMTs for treating developmental speech sound production disorders. Such approaches showed to have serious theoretical and empirical shortcomings. The profession of speech-language pathology has taken pride in clinical practices that are theoretically sound and supported by a self-generated research base (Siegel & Ingham, 1987). Today, however, unvalidated treatment methods are widely marketed under the guise of continuing education (Lof & Watson, 2008). It is time for the profession to fulfill its ethical responsibility to speak out in favor of evidence-based treatments on behalf of those who cannot speak out for themselves.

3Marshalla (2004) acknowledged contributions of electropalatography to the study of lingual movements (p. 83); however, the utility of the technology for the assessment and remediation of speech sound disorders was not addressed.
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